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ABSTRACT

To explore the possibility that the tendency to cluster during free recall reflects organizational processes that are central to the attainment of certain reading skills, 32 mentally handicapped subjects were asked to recall 20 words from four conceptual categories on four consecutive trials. For one group the words were presented in random order on all four trials. For the second group, the words were presented in categories on two trials and randomly on two trials. The subjects in each group were further divided into above and below median reading comprehension subgroups. The major findings were that organized word presentation increased clustering on subsequent nonorganized trials, and that the above median reading comprehension group clustered significantly more than the below median group. (Author)

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ABSTRACT

Thirty-two mentally retarded Ss were asked to recall twenty words from four conceptual categories on four consecutive trials. For one group, the words were presented in random order on all four trials. For the second group, the words were presented in categories on the first two trials, but in random order on the last two trials. The Ss in each condition were further divided into above and below median reading comprehension subgroups. The major findings were: (a) organized word presentation increased clustering on subsequent nonorganized trials and (b) the above median reading comprehension group clustered significantly more than the below median group.

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THE USE OF THE ASSOCIATIVE CLUSTERING TECHNIQUE IN THE STUDY OF READING DISABILITY: EFFECTS OF LIST ORGANIZATION[1]

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The associative clustering technique was introduced by Bousefield (1953) as a method for measuring spontaneous organizational tendencies during the free recall of verbal materials. This technique consists of presenting S with a series of words drawn from several conceptual categories. The S is then asked to recall as many words as possible. An above chance tendency has been observed for Ss to recall words from the same category in clusters, or consecutively, in spite of the fact that the words were presented in a random sequence.

The present study explored the possibility that the tendency to cluster during free recall reflects organizational processes that are central to the attainment of certain reading skills such as comprehension. This possibility was suggested by Braun (1963), who reported a statistically reliable correlation between reading comprehension and performance on a concept formation task. Further, the relationship between concept formation and reading comprehension was significantly stronger than the relationship between IQ and reading comprehension. The task employed by Braun required Ss to identify a concept represented on each of a series of cards. The organizational processes required for this concept formation task appear highly similar to those required for clustering.

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It is possible that the difficulty experienced by mentally retarded individuals in reading comprehension as well as other classroom activities is due to a basic inability to organize verbal materials. Several investigators have noted that mentally retarded Ss tend to cluster very little during free recall (Gerjuoy & Spitz, 1966, Gerjuoy & Alvarez, 1969, Rossi, 1963). Spitz (1966), after reviewing much of the clustering literature, concluded that mentally retarded individuals suffer from a deficit in their ability to organize input materials and that this deficit may be responsible for many of their learning difficulties.

A second purpose of the present study was to assess the effects of list organization on clustering and to determine whether these effects will transfer to performance on later trials with randomly organized lists. Several investigators have successfully increased clustering during immediate recall in mentally retarded individuals. Gerjuoy and Spitz (1966) devised three methods which significantly increased both clustering and recall for mentally retarded Ss. These methods were referred to as (a) presented clustered, in which all words from the same category were presented consecutively, (b) requested clustered, in which E requested the words by category name, and (c) presented-requested clustered, a combination of the first two methods. Gerjuoy, Winters, Pullen, and Spitz (1969) also found that the presented clustered method significantly increased clustering during immediate recall for mentally retarded Ss when the stimulus materials consisted of 20 single visual stimuli. In a second experiment, the same investigators found that the presented clustered method increased recall as well as clustering when the stimulus materials consisted of 40 paired visual stimuli.

The above studies have demonstrated that it is possible to increase

clustering during immediate recall. However, if increases in organizational skills are to facilitate classroom learning, it must be demonstrated that these increases will transfer from one situation to another. Gerjuoy and Alvarez (1969) failed to demonstrate that the effects of experience with a presented clustered list would transfer to a random list, composed of words from four different categories. The second list was presented one week after the first. In another study, however, Gerjuoy (1967) obtained transfer after giving Ss five trials a day for four days with a different presented clustered list each day. On the fifth day, Ss with four days' experience recalled significantly more words from a random list composed of new words than Ss with only one day's experience. Clustering performance was not reported in this study.

Guided by the above literature, the present study employed a 2 X 2 X 2 factorial design with repeated measures on one of the factors. The first factor was list organization. Equal numbers of Ss received either a random list or a presented clustered list on the first two trials of the session. All Ss received a random list on the last two trials. The second factor was reading comprehension level. Each list organization group was divided at the median into high and low reading comprehension subgroups. The repeated measures factor was trial blocks which consisted of the first two trials versus the last two trials.

Method

Subjects. The Ss were randomly selected from a pool of available Letchworth Village residents with Stanford Binet IQs between 45 and 70, CAs between 12 - 0 and 19 - 0, and Metropolitan Achievement Test scores obtained in June of 1968. This group was divided into above and below median subgroups on the basis of Metropolitan Achievement Test reading

comprehension scores. Equal numbers of Ss from each of these subgroups were randomly assigned to each of the two list organization conditions. The Ss were then randomly assigned to sessions and tested in order until 16 Ss had been obtained for each list organization condition. Whenever an S was unavailable for his assigned session, the next S was taken and the first S was tested as soon as he became available. Two Ss were eliminated and replaced because of irregularities in the testing procedure. In addition, one S for each list organization condition was tested and reserved as an alternate. Thus, a total of 36 Ss were tested, 32 of whom served as the final Ss for the present study. The 32 final Ss, 16 males and 16 females, had a mean Stanford-Binet (Form M) IQ of 56.97 (SD=5.14). The mean CA for this group was 183.72 months (SD=24.93). MAs were extrapolated from current CAs and the most recent available IQs. The mean MA was 101.19 months (SD-13.78). Mean reading comprehension grades were 3.06 (SD=.65) for the high comprehension group and 1.77 (SD=.40) for the low comprehension group. See Table I for subject characteristics within list organization conditions.

Stimulus Materials. Stimulus materials consisted of a single 20 word list which was presented in four different orders to each subject. The words, taken from Rossi (1963) were as follows: milk, head, bear, dress, bread, leg, coat, cake, horse, mouth, hat, sheep, nose, meat, belt, cat, soup, shoe, thumb, pig. On random trials, the words were randomly assigned to list positions with the restriction that no more than two words from a given category could appear consecutively. On clustered trials, the words within each category (food, clothing, animals, body parts) were presented consecutively. The order of words within categories corresponded to the order in which they appeared in the random list for

that trial. The order of categories corresponded to the appearance of the first word from that category in the random list for that trial.

The stimulus words were presented auditorily by means of earphones attached to a Cousino cartridge tape recorder. Recall instructions following each list were also presented via the tape recorder. The same words were presented visually by means of a Carousel slide projector and a HIP side screen viewer (7" X 5 1/4"). The slide projector and tape recorder were synchronized so that the auditory stimulus was presented one second after the onset of the visual stimulus, which remained on the screen for three seconds. The rate of presentation was one word every three seconds.

Procedure

Each S was tested individually for one 10 to 15 minute session. Two Es tested an equal number of Ss. Before trial 1, S was seated in front of the viewer and given the following instructions:

> I want you to do a word game with me. This is easy since you already know all of the words. Okay? Now, on this screen and through these earphones you will see and hear a number of words. When all the words have been given, I want you to tell me all the words you can remember. Do you understand? You will see and hear a number of words, and when all the words have been given, I want you to name all the words you can remember. Are there any questions? (E answered any relevant questions.) Okay? Now, let's begin.

Trial 1 began immediately. After all the words had been presented, S was instructed via the tape recorder: "Now say all the words you can remember. Think hard and take your time." E recorded all of S's responses, allowing S ample time to finish, but not prompting him to recall more words than he produced spontaneously. As soon as S indicated that he had finished, E said "Very good. Let's try again." The remaining three trials were conducted in the same manner, except that

the recall instructions were shortened to, "Now, say all the words you can remember."

Results

The design of the present study corresponded to a 2 X 2 X 2 factorial analysis of variance, with list organization, reading comprehension level, and trial blocks as the three independent variables. The two dependent variables of primary interest were (a) number of words clustered above chance and (b) number of correct words recalled.

Clustering. The amount of above chance clustering was found by subtracting expected or chance clustering from observed clustering. Expected clustering was obtained according to the following formula from Spitz (1966):

$$E(R) = \frac{m_1^2 + m_2^2 + m_3^2 + m_4^2}{n} - 1$$

where m_1, m_2, m_3, and m_4 are numbers of items recalled from each of the four categories, and n is the total number of items recalled. Observed clustering was defined as the number of times a stimulus word was followed by another stimulus word from the same category.

A summary of treatment group means and standard deviations is presented in Table II.

A 2 X 2 X 2 factorial analysis of variance with repeated measures on the third factor (trial blocks) was performed on these data. This analysis revealed two significant main effects and no significant interactions. The effects of list organization were significant at the .01 level ($F = 8.74$, $df = 1.28$) with the Presented Clustered Group clustering significantly more than the Random Group. The simple effects of list organization were computed to determine whether the

effects of list organization were significant within the second trial block. This analysis revealed that the effects of list organization were statistically significant at the .01 level for the second trial block (F = 15.16, df = 1,28), but not for the first trial block (F = 4.07, df = 1,28, $p > .05$).

The other significant main effect was that of reading comprehension at the .05 level (F = 4.67, df = 1,28). This analysis revealed that the high reading comprehension group clustered significantly more than the low reading comprehension group.

Correlations were computed between overall clustering scores and reading comprehension scores for each list organization condition. For the Random Group this correlation was significant at the .01 level (r = .77, df = 14). However, for the Presented Clustered Group this correlation was not significant (r = .13, df = 14, $p > .05$). A z test for significant differences between correlation coefficients indicated that the correlation coefficient for the Random Group was significantly greater than the correlation coefficient for the Presented Clustered Group at the .05 level (z = 2.27).

Recall. A summary of the treatment group means and standard deviations is presented in Table III.

A 2 X 2 X 2 factorial analysis of variance with repeated measures on the third factor (trial blocks) was performed on these data. This analysis revealed one significant main effect and no significant interactions. The effects of trial blocks were significant at the .01 level (F = 20.86, df = 1,28), with more words correctly recalled during the second trial block than during the first trial block.

Correlations were computed between recall scores and reading

comprehension scores for each list organization group. These correlations were not significant at the .05 level for either the Random Group (r = .45, df = 14) or for the Presented Clustered Group (r = .36, df = 14).

Discussion

The present study investigated the relationship between clustering and reading comprehension as measured by a standard reading achievement test. It was found that Ss with relatively high reading comprehension scores clustered significantly more than Ss with relatively low reading comprehension scores. A similar study (Evans, 1969) failed to reveal an effect of overall reading grade on clustering performance. Although further research is necessary to identify the parameters responsible for these discrepant findings, several differences between the two studies may be important. Both the reading scores and clustering scores reported by Evans were generally higher than those obtained in the present study. This suggests that a certain level of organizational ability may be required for the development of reading comprehension ability. However, once this level has been attained it is possible that other processes begin to play a role in determining reading comprehension levels. Another difference between the two studies was that Evans used overall reading achievement scores which included measures of comprehension, whereas the present study used reading comprehension subtest scores. However, high correlations between comprehension and other reading subtest scores in the present study suggested that the different reading measures used were probably not responsible for the different results obtained by the Evans study and the present study.

Another interesting related finding was the relationship between reading comprehension and clustering. The correlation between reading comprehension and clustering was significantly higher when clustering was spontaneous than when clustering was increased by the presentation of clustered lists. This suggests that perhaps only when the tendency to cluster is part of an individual's natural cognitive style is it related to his comprehension ability. Thus, in order to significantly improve reading comprehension performance, it would probably be necessary to establish somewhat stable tendencies for individuals to organize incoming verbal materials.

A second purpose of the present study was the investigation of the effects of experience with clustered lists on subsequent performance with unclustered lists. It was found that the group which received a clustered list in the first trial block produced significantly higher overall clustering scores than the group which received a random list in the first trial block. In addition, a highly significant effect of list organization in the second trial block indicated that increases in clustering had indeed transferred to performance with random lists. The present results are consistent with the findings of Gerjuoy (1967) who also obtained transfer from clustered to random lists with mentally retarded individuals. Gerjuoy observed increased recall with new random lists which were presented 24 hours after a series of presented clustered lists. The combined results of the gerjuoy study and the present study suggest that it may well be feasible to establish relatively stable and generalizable strategies for the organization of verbal materials. However, the conditions under which it is possible to establish these tendencies have not yet been clearly identified. Gerjuoy and Alvarez (1969)

failed to obtain transfer to either clustering or recall with a new random list after one day's experience with a presented clustered list. Differences between the Gerjuoy and Alvarez study and the two studies which did obtain transfer suggest several variables which may influence the amount and duration of transfer. Some of them are the degree of similarity between training and transfer lists, time between training and transfer, amount of training, amount of variety in training materials, and measure of transfer.

List organization failed to influence recall in the present study. However, several investigators have reported that the presented clustered method increases recall for mentally retarded Ss (Gerjuoy & Spitz, 1966; Gerjuoy, Winters, Pullen & Spitz, 1969; Spitz, 1966). The studies reporting increased recall provided S with more presented clustered experience than the present study. It is possible that a relatively large amount of experience with clustered lists is necessary before recall is facilitated, whereas clustering may be more readily susceptible to the effects of list organization.

The educational implications of the present study are several. First, the deficit in input organization evidenced by mentally retarded Ss may very well be a basis for their difficulties in areas such as reading comprehension. Second, the present findings would suggest that it is possible to increase the effectiveness of organizational skills in mentally retarded individuals. Third, it has been demonstrated that the effects of increased organizational skills will transfer from one situation to another, although the conditions necessary for long term transfer have not yet been clearly identified. Finally, the above findings suggest that it may be possible to

facilitate performance on educational tasks such as reading comprehension in mentally retarded individuals by remediating specific deficiencies in input organization.

TABLE I

Subject Characteristics within List Organization Groups

	Random		Clustered	
	Mean	SD	Mean	SD
IQ	58.43	5.25	55.50	4.73
CA*	180.56	26.85	186.87	23.29
MA*	102.06	14.75	100.31	13.16
Reading Comprehension Grade	2.29	.77	2.54	.92

* In months

TABLE II

Means and Standard Deviations for Above Chance Clustering Scores within Treatment Combination Groups

	Random				Clustered			
	Trial Block 1		Trial Block 2		Trial Block 1		Trial Block 2	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
High Reading Comprehension	.93	1.35	.32	1.78	2.02	2.02	3.77	2.97
Low Reading Comprehension	-.42	.44	-.31	1.43	1.06	3.05	1.20	2.01

TABLE III

Means and Standard Deviations for Number of Words Correctly Recalled within Treatment Combination Groups

	Random				Clustered			
	Trial Block 1		Trial Block 2		Trial Block 1		Trial Block 2	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
High Reading Comprehension	15.88	4.46	20.50	9.49	17.62	3.87	25.62	7.84
Low Reading Comprehension	13.75	4.20	17.88	8.64	16.00	4.87	20.62	6.04

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